User-Centred Design of FIAT Blue&Me

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What is Blue & Me?

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- A multifunctional system (phone, mp3, navigation, services...)
- A more secure system (hands-free functions interaction)
- A multimodal system (manual/visual and vocal/auditory interaction)
- A system that integrates customer personal devices to give the customer – even while driving – a continuous, safe and optimized access to favorite services.
- A competitive, easy and extensible system, based on commercial standard HW and SW platforms

What's Blue & Me?

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Why UCD for Blue&Me development?

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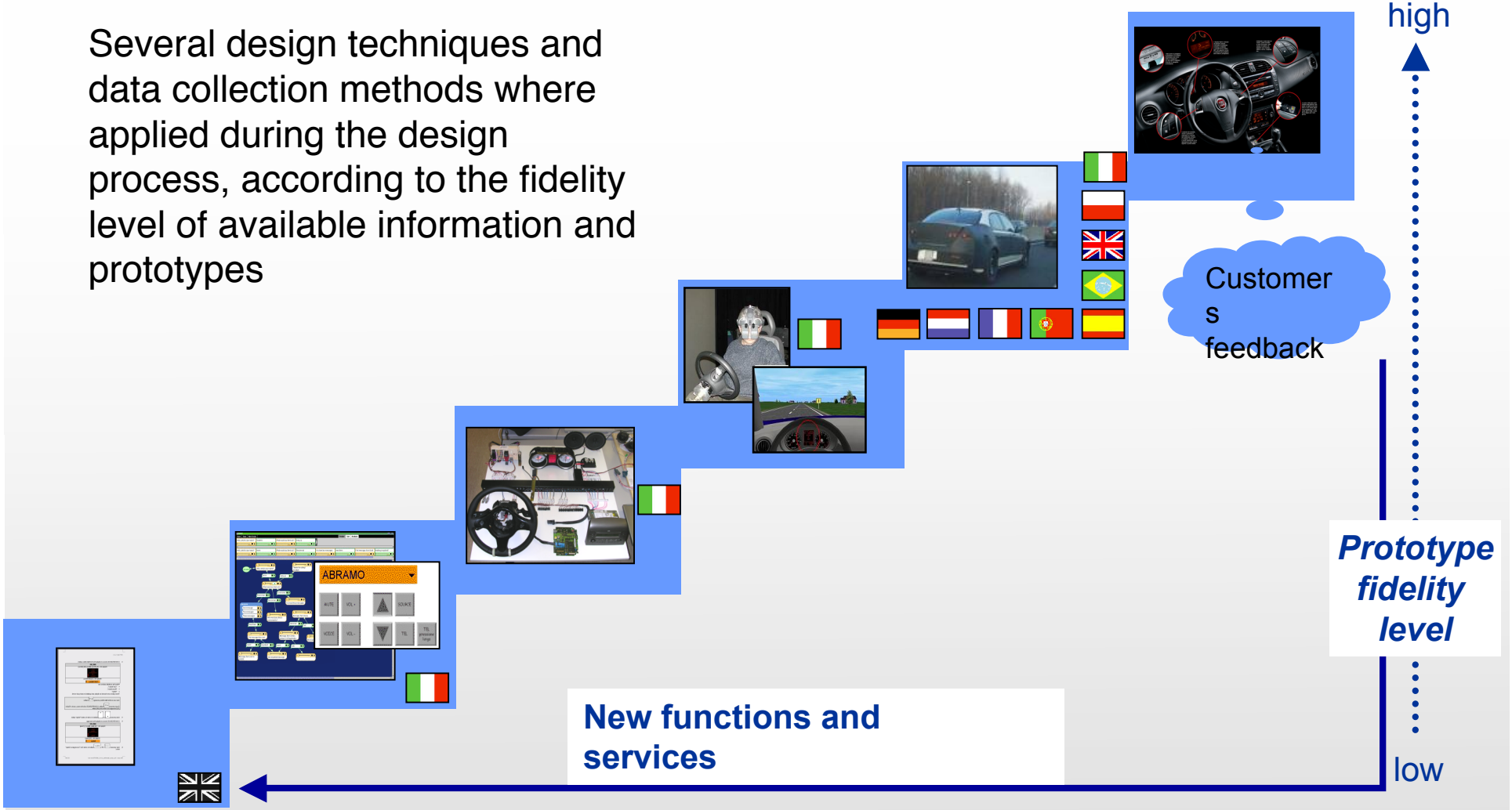
UCD has been implemented and applied extensively in the mainstream development of Blue&Me, involving all industrial actors and groups of potential customers, in order to:

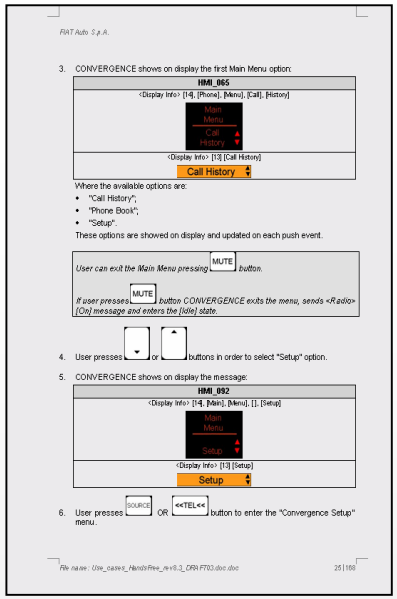
- Ensure best adequate usability of a concept which is new both for FIAT and for its customers, and is the first of its kind on the market worldwide
- Move upstream critical choices and checks, for a system which rises unprecedented human factors and technological issues to FIAT E&D functions (e.g. massive vocal interaction, multicultural design, expandability, integration in vehicle)

User-centred design process

Several design techniques and data collection methods where applied during the design process, according to the fidelity level of available information and prototypes



Use Cases documents


FIAT Auto S.p.A.

3. CONVERGENCE shows on display the first Main Menu option:

HMI_065

<Display Info> [1/4], [Phone], [Menu], [Call], [History]

Main Menu

Call History

<Display Info> [1/3] [Call History]

Call History

Where the available options are:

- "Call History";
- "Phone Book";
- "Setup".

These options are showed on display and updated on each push event.

User can exit the Main Menu pressing MUTE *button.*

If user presses MUTE *button CONVERGENCE exits the menu, sends <Radio> [On] message and enters the [Idle] state.*

4. User presses ↓ or ↑ buttons in order to select "Setup" option.

5. CONVERGENCE shows on display the message:

HMI_092

<Display Info> [1/4], [Main], [Menu], [], [Setup]

Main Menu

Setup

<Display Info> [1/3] [Setup]

Setup

6. User presses SOURCE OR <<TEL<< button to enter the "Convergence Setup" menu.

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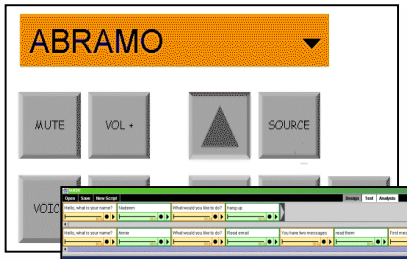
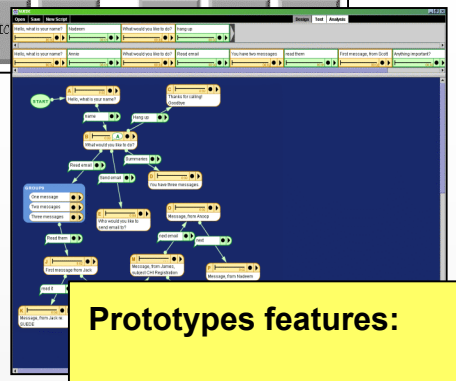
Use Cases doc:

- Documentation (English)
- Information flows
- Information content
- Technical parameters (timeouts, events, ...)

- **Aim:** to identify possible usability issues
- **Type of evaluation**: usability experts analysis of available documentation (Use Cases draft specification)
- **Output**:
  - identification of critical tasks on both Graphical User Interface and Speech User Interface
  - Human Interaction based model
    - prioritization of tasks according to frequencies of use of different functions
    - prioritization between the different function vs driving conditions
  - Design of the Italian version of the system

Low fidelity prototypes





Prototypes features:

- PC simulation
- Vertical prototypes (Italian)
- No input devices (mouse)
- No driving task
- No interaction with other in-vehicle functions

- **Aim:** to understand with final users, the effective usability of the system on different identified critical tasks.
- **Types of evaluation**: usability users test
- **Tools**: low fidelity PC vertical prototypes (parallel design)
  - Power Point & Denim for manual interaction
  - Suede for Wizard of Oz;
  - Camtasia to collect objective data
- **Output**: guidelines to design team
  - buttons labels and positions
  - menus chunking and flow
  - GUI layouts on different displays
  - vocal interaction flow and turn taking
  - vocal prompts content

Medium fidelity prototype (I)

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- **Aim:** to understand the usability of the system both in manual and vocal interaction.

- **Type of evaluation**: usability experts iterative tests on Italian source language

- **Tools**:
  - laboratory prototype
  - software tools to modify TTS parameters, GUI labels, voice commands

Prototypes features:

- Laboratory prototype
- All functionalities (Italian)
- Real input devices
- Real output devices
- No driving task
- Interaction with other in-vehicle functions

- **Output**:
  - GUI labels
  - GUI layout for different information
  - Vocal commands lexicon (Italian)
  - TTS lexicon, syntax and prosody
  - Timeout parameters

Medium fidelity prototype (II)

Prototypes features:

- TTS messages
- Actress prerecorded messages

- **Aim:** to understand the perceived quality of TTS voice.
- **Type of evaluation**: Italian users tests, comparison with real voice
- **Tools**:
  - laboratory prototype
  - pre-recorded messages (actress)
- **Output**:
  - subjective evaluation of TTS voice quality

VR medium fidelity prototype

Prototypes features:

- Virtual Blue&Me prototype
- All functions (Italian)
- Real input devices
- Virtual output devices
- Driving task
- Interaction with other in-vehicle functions
- Interaction with virtual driving environment

- **Aim:** to understand the different impact on driving for both manual and vocal interaction.
- **Type of evaluation**: users tests in VR
  - Woz for vocal interaction
- **Tools**:
  - virtual B&M HiFi prototype, integrated in the CRF VR driving simulator
  - software tools to collect and process data on driving performance and on users interaction with Blue&Me
- **Output**:
  - identification and classification of distracting task types for both manual and vocal interaction

High fidelity prototype (I)

Prototypes features:

- Car prototype
- All functionalities (Italian)
- Real input devices
- Real output devices
- Driving task
- Interaction with other in-vehicle functions
- Interaction with driving environment

- **Aim:** to understand the usability of the system while driving.
- **Type of evaluation**: user usability in-the-field test on Italian language prototype
- **Tools**:
  - car prototype
  - questionnaires and observational grids
  - software tools to collect driving data and Blue&Me interaction data (log files)
- **Output**:
  - Usability of the system (effectiveness, efficiency, users satisfaction)
  - Timeout parameters

High fidelity prototype (II)

Prototypes features:

- Car prototype
- All functionalities (8 languages)
- Real input devices
- Real output devices
- Driving task
- Interaction with other in-vehicle functions
- Interaction with driving environment

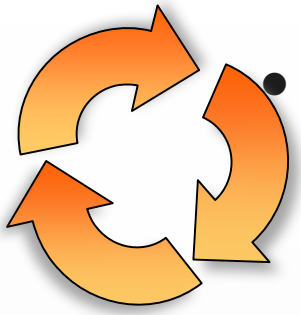
- **Aim:** to understand the usability of the system in different languages and identify possible language-dependency issues
- **Type of evaluation**: usability test with mother tongue users on 9 different languages
- **Tools**:
  - car prototype
  - questionnaires and observational grids
  - software tools to collect Blue&Me interaction data
- **Output**:
  - Usability of the system (effectiveness, efficiency, users satisfaction) in different languages

Follow up

System on market

- **Aim:** to collect information from customers and evaluate usability with “expert final users”
- **Type of evaluation**:
  - experts analysis on collected data
  - on-field tests
- **Tools**:
  - customers complaints internal collection tools
  - questionnaires and observational grids
- **Output**:
  - Guidelines to improve and re-design the HMI for new versions, applications and services

Conclusions



The development of FIAT Blue&Me followed:

- principles of the User-Centred Design approach (s*tandard ISO 13407 - Human-centred design processes for interactive systems):*
  - ☐ Proper allocation of functions between users and Blue&Me system
  - ☐ Active users' involvement
  - ☐ Iterative process
  - ☐ Multidisciplinary design team (Engineers, Cognitive and Physical Ergonomists, Designers, Sw and Hw experts, Testing experts, Vocal technologies experts, Product and Marketing experts…) of different international companies
- **and its phases**:
  - ☐ Know users
  - ☐ Define requirements
  - ☐ Design and prototype
  - ☐ Do usability evaluations
  - ☐ Follow an evaluation and redesign iterative process
  - ☐ Do follow-up studies after launch Blue&Me on the market

Epilogue: was it worth?

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The implementation and application of UCD on Blue&Me:

- Has allowed to identify, target and handle key usability issues since the early stages, by steering improvements during development, involving all actors with a teamwork approach and almost eliminating late modifications and patches
- Has made possible a trusted launch on the market of an innovative concept, within severe time constraints, with high confidence in a positive response of the market
- Has made available new and improved methodologies for new issues and problems, of specific and wider validity
- Has fostered the extension of this approach to the wider domain of HMI vehicle systems and functions, up to the level of prompting organizational changes in FIAT R&D functions.

Fiat Partners in Blue&Me Project

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Fiat Group Automobiles SpA

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Microsoft

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Thank you!